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ABSTRACT

A convenience sample of 46 subjects was selected from 104 elementary through secondary self-selected students who participated in a prototypical voluntary after-school and summer computer camp operated by an American southwestern nonprofit educational research laboratory. Following an initial 16-hour exposure to LOGO and Bank Street Writer, a minimal shift toward an internal locus of control was found for children 12 years of age or less (paired 1-tailed t-test significant at .03), as measured pre- and post-test with the Nowicki-Strickland Locus of Control (LOC) Scale for Children. The LOC scale was chosen as an operationalization of Seymour Papert's concept of "empowering children" via microcomputer interaction. Because prior research on LOC has associated an internal LOC with positive learner attributes, it was felt that such an investigation could assist researchers in more clearly distinguishing between the reaction of different groups toward technology as a tool. Study findings include data which indicate that the study group did demonstrate a significant shift towards internality, "planning" seems to be poorly regarded by even the most "internal" of students, and the subject's self-acceptance experienced a negative shift from pre- to post-tests. (Author/JB)

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LOCUS OF CONTROL AMONG
COMPUTER-USING SCHOOL CHILDREN

A REPORT
OF A PILOT STUDY

Steven Louie

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ABSTRACT

Forty-six high SES school-aged children (9-15 y.o.) participated in a prototypical after-school and summer computer camp provided by an independent non-profit research laboratory. Following an initial 16-hour exposure to Logo and Bank Street Writer, children 12 years of age or less were found to minimally shift towards an internal locus of control (paired 1-tailed t-test significant at .03), as measured pre-and post-test with the Nowicki-Strickland Locus of Control (LOC) Scale for Children. The LOC scale was chosen as an operationalization of Papert's concept of "empowering children" via microcomputer interaction. Because prior research on LOC has associated an internal LOC with positive learner attributes (such as the ability to delay gratification, persist on task, greater tendencies toward beneficial social interaction, less dogmatism, academic competence, social maturity, and possibly a correlate of independent, striving, and self-motivated behavior), it was felt that such an investigation could assist researchers in more clearly distinguishing between the reaction of different groups towards technology as a tool. Treatment consisted of a semi-structured sixteen-hour (16) microcomputer experience in a class/lab environment.

Software used in the study was restricted to Logo and Bank Street Writer. Classification of the LOC instrument by topic and response suggests that even highly internal-scoring children do not regard "planning" as an important process leading to successful outcomes in life. The relationship of this finding to a recent study conducted by Bank Street College utilizing Logo is discussed.

Educational Computing:
Humanizing Tool or Skinner Box?

Reinforcement has long been recognized as a major process contributing to behaviors associated with successful learning and applied intelligence among school children (Estes, 1984). As the use of educational technologies continues to proliferate in schools, there is likely to develop a natural concern on the part of the public over the appropriate use of devices such as microcomputers in the classroom and whether or not the reinforcement provided by these machines is beneficial.

Advocates of educational computing argue that didactic programming with languages such as Logo, utilization of Computer Based Instruction (CBI), Computer Managed Instruction (CMI), Computer Assisted Instruction (CAI), simulations, telecommunications, word processing and a host of other technology-related activities are beneficial, intrinsically motivating as games with embedded instructional content and represent an unprecedented revolution in how, what, when and where students can learn (Papert, 1983; Kulik, 1983; Mallone, 1981).

Ideology, Self and Empowerment

It was felt that issues surrounding the use of reinforcement and feedback with regard to an operational definition of the concept of "empowerment", as used by writers such as Papert (1980), needed to be addressed.

Seymour Papert and others have portrayed the presumably microcomputer-based "empowerment" of children as leading to the playful acquisition and manipulation of "powerful ideas" (Papert, 1980; Watt, 1983). The issue of reinforcement and the means by which intelligent machine-child interactions may influence children's unassisted learning processes in everyday life have not been adequately investigated. While Papert has suggested that discovery-oriented educational computing is superior to learning processes guided by more structured and goal-oriented systems (such as CAI), his arguments have tended to be founded on more intellectual and aesthetic values than research data. Implicit in Papert's thinking, however, is the notion that the child as "mathematician-discoverer" (versus the child as subordinate and tutee-student of a mathematician-teacher) retains control. That is, the LOC is more internalized with Logo learning than say, traditional classroom learning.

Locus of Control

According to social learning theory, an individual's reinforcement responses in the past will influence their perception of educational objects (technology-related or not) and their expectations of success within a given educational environment. It is expected that this perception will vary in degree from person to person and will vary within an individual over time.

Rotter (1966) described a dimension of LOC of reinforcement as follows:

When a reinforcement is perceived by the subject as following some action of his own but not being entirely contingent upon his action, then, in our culture, it is typically perceived as the result of luck, chance, fate, as under the control of powerful others, or as unpredictable because of the great complexity of the forces surrounding him. When the event is interpreted in this way by an individual, we have labeled this a belief in external control. If the person perceives that the event is contingent upon his own behavior or his own relatively permanent characteristics, we have termed this a belief in internal control [p. 1].

Shifting Towards the Internal

Clearly, there is a need to evaluate reinforcement and LOC in the application of educational technologies in the classroom. It should be noted that many tutorial and drill and practice software packages make extensive use of visual

and auditory reward systems which are essentially continuous reinforcement schedules. If LOC does play a significant part in a child's interpretation of such reinforcement and its relationship to events occurring in reality, then software design should be influenced in the light of such research findings.

Both Logo and Bank Street Writer are software products that are potential "tools" for their users. That is, in the case of Bank Street Writer, a word processor designed by the Bank Street College of Education, the software permitted children in the project to easily conceptualize, implement and refine a writing task presented to them (in the case of this study, the children were asked to create "self-scripts"). Logo is a programming/learning environment that many educators have found useful in converting otherwise abstract ideas about geometry into more fathomable graphics processes. It should be noted that neither Logo nor Bank Street Writer make use of a systematic schedule of reinforcements in order to carry on their primary learning activities, whereas some CAI applications make extensive use of such systems. It was felt that software designs which permit users to adapt such applications to both goal-oriented (possibly extrinsically motivated objectives) and less structured, intrinsically

motivated, discovery-based learning processes would maximally serve to enhance any shifts towards an internal locus of control. In contrast with CAI software designs that use more restricted sets of reinforcement contingencies, Logo and Bank Street Writer are open to "self-determined" rewards generated in response to an ever changing set of circumstances. That is, a student's response to creating a "self-script" with word processing and a Logo "self-portrait" is based more upon intrinsically determined factors than a drill-and-practice software package that flashes a "happy face" for each and every correct answer keyed into the computer.

At least one alternative, that of determining the impact on student LOC through the use of software consisting strictly of CAI applications where more restricted reinforcement contingencies are applied, was not investigated. Additionally, no attempt was made at the time of this pilot study to determine any association between the computer-based interactions students experienced, and their eventual scores on any performance and/or achievement measures.

In order to test a hypothesis that Logo and Bank Street Writer have an influence on some children and

that this influence is likely to be a shift in the direction of an internal LOC, the null hypothesis was conceived of as no difference in paired t-test scores. It was felt that a rejection area encompassing .05 was adequate to set alpha.

Due to the extensive body of research already associated with LOC in other areas, and the easy accessibility of the Nowicki-Strickland Locus of Control Scale for Children by potential participants outside of this project (both in research laboratories and in classrooms), it was believed that this represented an opportunity to synthesize new material regarding the use of microcomputers in the classroom that would be widely useful. From the standpoint of the generalizability of the findings, the long history of LOC evaluations is exemplified in the work of Coleman, Campbell, Hobson, McPartland, Mood, Weinfeld, and York, who studied almost half a million youngsters across the United States (1966) and found that a belief in destiny was a major factor in school achievement.

Within the context of this study, children were asked to use Logo and Bank Street Writer as tools for projecting their own expectations for themselves. They were also asked to use the computer to create a tangible artifact that would

represent themselves as possessor's of a social "identity"
and as members of a simulated community.

Population

Subjects were children almost entirely enrolled in elementary through secondary grades within one school district in the southwest. Participants from this school district represent a select population of students in terms of their performance on CAT tests. Consistently rated among the state's top performers, grade equivalents for the sixth grade show students in this district ranging from 9.0 in math to 10.9 in grammar (Tucson Daily Star/Citizen, 1984). At the time of the study, the district as a whole had shown steady improvement in test scores for at least four years.

Ninety-nine (99%) percent of the subjects came from an area where the median annual household income is \$35,893 (highest in the area). The median age of the parents was 35.5 years of age with eight (8%) percent of that sample being newcomers. Seventy-nine (79%) percent of the sample parents and/or guardians were homeowners. The length of residence for the families participating in the study is represented by Table 1. Distribution of the subjects by age and gender are detailed in Table 2.

Table 1. Length of Residence

Less than 1 year	1-5 years	6-10 years	More than 10 years	Total
8%	33%	21%	38%	100%

Table 2. Age and Gender Characteristics of Sample

	Age	Females	Males	Combined
Mean	09-15	11.538	10.909	11.09
Standard Dev.	09-15	01.664	01.826	01.79
Frequencies	09-15	13.000	33.000	46.00
	09	01.000	09.000	10.00
	10	04.000	08.000	12.00
	11	01.000	05.000	06.00
	12	03.000	05.000	08.00
	13	02.000	02.000	04.00
	14	02.000	02.000	04.00
	15	00.000	02.000	02.00

Method

One hundred four (104) elementary through secondary self-selected students participated in a prototypical-voluntary after school and summer computer learning laboratory operated by an American southwestern nonprofit educational research laboratory. Data was collected over a 9-month period from March to December 1984 as a part of an on-going project. All subjects were from high SES families.

No attempt was made to screen for learning disabilities and/or emotional handicaps. Of the 104 original subjects, all were pre- and post-tested and were stratified by age prior to analyses. Due to prior experience with Logo programming and word processing, a decision was made to eliminate data collected from children less than 9 years old based upon their general reading ability and comprehension of the given task. Because both Logo and Bank Street Writer are currently more associated with the elementary and middle school curriculum, it was also decided that data collected on subjects greater than 15 years of age would be dropped from the sample.

A convenience sample of 46 subjects were selected from the above population and pre-/post-test scores were evaluated. Manipulation of the raw data for the study was performed via Multiplan on a microcomputer and SPSS (DEC-10/ Cyber-175). The sample consisted of children ranging in age from 9 to 15 years of age. Thirteen of the subjects were female. All subjects were new to microcomputing and without prior programming and/or word processing experience.

Measurement

The Nowicki-Strickland Locus of Control Scale for Children is a 40 question forced-choice (yes/no) test that was administered by paper-and-pencil (see Appendix A). The items involve reinforcement situations dealing with interpersonal and motivational areas. The test was written for a fifth-grade level but involves choices appropriate for older children. The LOC scale was administered to children by the certified teaching staff at the research site on an individual basis. The same subjects were measured before and after the treatment (self-pairing).

Nowicki and Strickland (1973), reported test-retest reliabilities for a 6-week period of 0.67 for the 8-11 year old group and 0.75 for those in the 12-15 year old group. Subjects in the study were initially tested 1-2 hours into a 16-hour group of classes that focused exclusively on using only two software packages for instructional purposes: 1) Bank Street Writer (64K version); and, 2) Terrapin Logo version 1.3. Students worked on Apple IIE microcomputers with single disk drives and Amdek Color I monitors, and the groups had access to several dot matrix printers.

Retesting at the 12-14 hour level of instruction took place. Students enrolled for 2-hour blocks of classes per

week, once a week. Demographic data collection took place upon entry into the laboratory in conjunction with information supplied by parents.

Students were instructed in the following manner, upon intake into the project:

1. They were going to be part of a dynamic on-going simulation called the "City of Asgard".
2. They were not yet citizens and had to establish themselves as such by learning how to do several things on the computer.
3. Independent learning and experimentation was encouraged. Teachers were instructed to let students know that they should ask other students for help prior to seeking the help of the teacher. "Ask three before you ask me."
4. Students were required to produce a paper-and-pencil "Self-portrait" and a handwritten "Self-script".
5. Word processing was initiated at the text insertion level without introduction of extraneous information about the operating system, start-up of the system and the like. Students immediately began copying their hand-written text using the

computer with word processor software preloaded and learned functions such as printing, saving and other features as they were required.

6. Logo programming was started from the editor mode, without any experience given to the students in "pilot navigation" in the immediate mode. A direct instruction period whereby essential Logo primitives, screen locations and recursion was performed in a highly structured format. Students first created a box, made a "name" program of arbitrarily chosen commands and then created a "master" program that permitted fixed or variable level repeats of the called subroutines.
7. Students were aware that following their 16-hour instructional period, a project that included their self-portrait and self-script would be incorporated into a "computer recital" or demonstration for their parents and peers.
8. Teachers were instructed to respond to questions with leading questions, permitting students to deduce answers on their own as much as possible.
9. Following acceptance as a citizen of "Asgard" (a name suggested by one of the participants) students

were then permitted to establish a business that would involve trading and inter-action with other students in the project. Design of the business, development of advertising and interaction with participants was accomplished with only Bank Street Writer and Logo as mentioned above.

10. Students worked on projects for approximately 90 minutes during each session and then were given the option of either continuing to work on their projects or play arcade-type games on their computer. Choice of the game was determined by the student.
11. Printouts of the computer self-portraits and self-scripts were posted throughout the center and a central communications area was established.
12. All teachers participating in the project attended once a week training sessions that focused on enhancing their computer skills and knowledge of project protocols.

Enrollment in the study was open-ended and the group did not formally begin at any point in the project period. No requirements for content achievement in Logo programming or proficiency in word processing via Bank Street Writer were specified. Keyboarding proficiency was not evaluated.

Results and Discussion

While the original Nowicki-Strickland subjects (1,017 mostly Caucasian students) represented a broad demographic spread, Nowicki-Strickland (Table 3) found no correlation with regard to socioeconomic level, but that internality was significantly related to higher parental occupational levels, especially for males. Thus, the post-test scores of the study are reflective of the select population sampled by the researchers. All students were from high SES families where there was usually at least one, frequently two, professional occupational levels represented in the study households, and all students were either Caucasian or Oriental.

The null hypothesis had been that there would be no significant difference between pre- and post-test scores on the Nowicki-Strickland Locus of Control Scale for Children. That is, the treatment condition of the children using microcomputers for 16 hours with Bank Street Writer and Logo was hypothesized to have no effect and that there would not be any measurable shifts. Alpha was set at 0.05.

Table 3. Means and Standard Deviations of Nowicki-Strickland Locus of Control Scores (1973) vs. Study Scores. (n = 46)

Grade	4	5	6	7	8	9	10
NSS-M	13.03	13.02	12.25	11.86			
NSS-S	3.91	5.33	4.98	4.89			
PRG-M	24.30	27.00	24.83	27.25	27.50	31.00	26.50
PRG-S	4.47	3.46	2.99	4.40	3.11	3.56	2.12
POG-M	26.20	27.83	26.83	27.00	27.25	31.75	26.00
POG-S	5.67	5.95	4.92	3.96	5.68	5.38	5.66
N	10	12	6	8	4	4	2
Age	9	10	11	12	13	14	15

NSS-M = Nowicki-Strickland Mean
 NSS-S = Nowicki-Strickland Standard Deviation
 PRG-M = Pre-test Mean (Group Score)
 PRG-S = Pre-test Standard Deviation (Group Score)
 POG-M = Post-test Mean (Group Score)
 POG-S = Post-test Standard Deviation (Group Score)

Superficial examination of Table 3 seems to suggest that the nine and eleven year olds in the sample were most likely to experience an internal shift. The data was further subjected to analysis by paired T-test, with the pairs defined as Pre- versus Post-test scores for each participating student (see Appendix B). Table 4 represents a summary of the paired T-tests.

Table 4. Paired T-Test Scores by Group, Gender and Age

	Difference in Means	SD	SEm	Corr.	df	1-Tail Prob
Group	.87	3.13	.462	.801	45	.033
Females	1.15	3.26	.905	.787	12	.113
Males	.76	3.12	.544	.806	32	.087
9 Year Olds	1.90	4.07	1.286	.702	09	.087
10 Year Olds	.83	3.07	.886	.922	11	.183
11 Year Olds	2.00	3.57	1.461	.691	05	.114
12 Year Olds	.25	2.19	.773	.868	07	.378
13 Year Olds	.25	2.75	1.377	.972	03	.433
14 Year Olds	.75	2.50	1.250	.923	03	.295
15 Year Olds	.50	3.53	2.500	1.000	01	.437
< 12 Years	1.08	3.28	.547	.770	35	.028
> 12 Years	.10	2.51	.795	.947	09	.451

Based upon the data analyzed for this study, it appears that the study group did demonstrate a shift towards internality that was significant. Furthermore, stratification of the sample by age revealed that children less than 12 years old were more likely to shift towards the internal. Due to the small size of the sample however, it was not known if this difference in shifts was specifically due to the treatment condition or to the possibility that an extremely select group of younger children are more likely to take computer classes than older children.

The magnitude of the shift determined from this study is not such that it would prompt the researcher to substantively recommend utilization of the computer techniques described over other methods of promoting an internal shift in a student's LOC, without further investigation.

Discussion

Nowicki (1971) has found a relationship between an internal locus of control and grade point averages. Correlations between locus of control and reading and mathematics achievement has been determined by Roberts (1971). Horak and Horak (1982) suggest that high internals can discriminate general principles via a guided discovery process through

inductive methods. In contrast, deductive methods require teachers to take responsibility for students with a high external locus of control.

Even though the original Nowicki-Strickland studies were able to demonstrate significant correlations between locus of control scores and achievement primarily with males, it is interesting to note that the present study does not affirm a difference in gender LOC with regard to micro-computer use. The literature on LOC suggest that an internal score is "significantly related to academic competence, to social maturity, and appears to be a correlate of independent, striving, self-motivated behavior" (Nowicki, 1973).

Stanton (1982) recently used relaxation techniques as a means of modifying perception of LOC and found that 36 secondary school subjects maintained an internal shift in LOC over a 12-month period following 4.5 hours of treatment. Indeed, this study indicates that the subjects were more internal at the end of 12 months than at the conclusion of the study.

Item review of the LOC scale included an evaluation of items relative to their group internality scores. Identification of items most likely to produce internal or external

shifts in responses was obtained. The three questions shifting most externally were, as follows:

Externalizing Questions

1. When you get punished does it usually seem it's for no good reason at all? (65% = yes)
2. Do you believe that your parents should allow you to make most of your own decisions? (61% = no)
3. Most of the time, do you feel that you can change what might happen tomorrow by what you do today? (57% = no)

The three questions exhibiting the most internal shifts among the students were:

Internalizing Questions

1. Do you believe that when bad things are going to happen they just are going to happen no matter what you try to do to stop them? (81% = no)
2. Do you think that kids can get their own way if they just keep trying? (64% = yes)
3. Do you feel that it's easy to get friends to do what you want them to? (31% = yes)

Of interest in the item review was the finding that only 18 percent of the children sampled believed that planning ahead makes things turn out better. When stratification by subjects indicating the greatest shifts toward an internal LOC was calculated, it was found that none of the subjects believed that planning makes any difference.

From the top 14 percent of the LOC scores, only 3 out of 10 subjects believed that planning made any difference. While this finding is hardly surprising in light of the Bank Street College study by Roy Pea (1983) that found no improvement in planning skills among Logo-using students, it does demonstrate that "planning" is poorly regarded by even the most "internal" of students. Indeed, it seems that neither software nor hardware seem to make any sort of appreciable dent in children's attitudes towards planning.

The investigators classified the items in the LOC scale into four areas: 1) self-acceptance/self concept; 2) outer control; 3) authority responsiveness; and, 4) social acceptance/group cooperation. Using the differential method of identifying items that produce a shift from pre- to post-tests, it was discovered that the subjects tended to shift towards an external LOC in the areas of authority responsiveness and self-acceptance/self-concept. This may be related to the observed behavior of the children at the computer. Many children regard the computer as a challenging "toy" and may come to feel challenged with respect to "mastering" the instrument. While the former may explain why the subjects' self-acceptance experienced a negative shift, the change in responsiveness to authority is harder

to explain. Perhaps the change may be related to a sense of dependence upon adult authority figures for information about how to make use of this powerful new toy. If so, this explanation is even more reason to adequately prepare teachers through effective inservice programs. Obviously, the issues discussed are in need of further research.

Among the areas most influenced towards an internal shift, students reacted to those items related to outer control and then social acceptance/group cooperation. From the standpoint of Papert's assertions about "empowerment" and increased cooperativeness among students using microcomputers and software such as Logo and Bank Street Writer, it would appear these are moderately justified claims with respect to the sample investigated (see Table 5).

Table 5. Grouped Difference Scores in LOC Scale Items.

=====							
LOC Sub-Construct Area	:	LOC Scale Items				:	Shift Diff.

Authority	:	05	09	11	14	:	(external)
Responsiveness	:	15	26	31	35	:	-5

Self-Concept/ Self-Acceptance	:	02	04	06	16	22	23: (external)
	:	23	28	30	32	38	40: -4

Group Cooperation/ Social Acceptance	:	12	18	20	25	27	: (internal)
	:	33	34	36	37	39	: 13

Outer	:	01	03	07	08	10	: (internal)
Control	:	13	17	19	21	24	29: 16
=====							

The results of this prototypical study have raised many further questions about the impact of computer-based reinforcement upon students' perceived locus of control. Since "empowerment" operationalized as increased sociability and confidence in manipulation of one's external environment may significantly alter the rate at which learned material "transfers" or generalizes in problem-solving situations, the author had speculated that LOC measures may be well worth examining as a bundled component of content criterion-referenced questions. The on-going study is now focused on comparing non-computer using groups and the population of available teachers.

It is interesting to note that, while our study focused primarily upon the LOC of computer-using students, the impact of technology is such that even more highly integrated educational technology engines incorporating interactive video, voice recognition, artificial intelligence and robotics are likely to have an effect upon the individual student exposed to this environment.

From the standpoint of new windows into human learning processes, in 1978, Holliday and Munz presented a paper at the Biofeedback Society of America which described a

significant shifting of LOC towards the internal by non-psychosomatic subjects trained in biofeedback.

It should be noted that the investigator's original hypothesis concerning operationalization of Papert's concept of student empowerment is, in this instance, directly tied to the given capability of a technology at a given moment. Thus, while current generations of Logo and Bank Street Writer produced the reported levels of shifts in LOC in this study, the researchers now hypothesize that the magnitude of the shift will be influenced by developments in hardware and software, and by the degree of technology integration achieved. As systems become more and more transparent to users, and as technology utilization incorporates new information about human learning processes, it is anticipated that there will be an increasing need to understand the evolving nature of human-machine reinforcement.

References

- Bardwell, R. How Feedback Functions, Education Digest, 47, 1982. 23-26.
- Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartland, J., Mood, A.M., Weinfield, F.D., and York, R.T. Equality of Educational Opportunity. (Superintendent of Documents, Catalog No. FS 5.238:38001) Washington, D.C.: United States Office of Education, 1966.
- Estes, William K. Learning, Memory and Intelligence. In Sternberg, Robert J. (Ed.) Handbook of Human Intelligence. Cambridge: Cambridge University Press, 1984.
- Holliday, J.E. and Munz, D.C. EMG Feedback Training and Changes in Locus of Control for Persons with Psychosomatic Problems. Paper presented at the ninth annual meeting of the Biofeedback Society of America, Albuquerque, N.M., March 1-7, 1978.
- Horak, Virginia M. and Horak, Willis J. The Influence of Student Locus of Control and Teaching Method on Mathematics Achievement. Journal of Experimental Education, 51 (11), Fall 1982. 18-21.
- Malone, Thomas W. Toward A Theory of Intrinsically Motivating Instruction, Cognitive Science, 4 (1981), 333-369.
- Nowicki, S., Jr., & Roundtree, J. Correlates of Locus of Control in a Secondary School Population, Developmental Psychology, 4, 1971. 477-488.
- Nowicki, Stephen and Stickland, Bonnie R. A Locus of Control Scale for Children, Journal of Consulting and Clinical Psychology, 40 (1), 1973. 148-154.
- Papert, Seymour, Mindstorms: Children, Computers, and Powerful Ideas, New York: Basic Books, Inc., 1980.

Pea, Roy D., and Kurland, D. Midian, Logo Programming and the Development of Planning Skills, Technical Report #16, Bank Street College of Education, Center for Children and Technology, December 1983.

Rotter, James B. Generalized Expectancies for Internal Versus External Control of Reinforcement. Psychological Monographs, 80, 1966 (1, Whole No. 609).

Stanton, H.E. Modification of Locus of Control: Using the RSI Technique in Schools, Contemporary Educational Psychology, 7, 1982. 190-194.

Item	Response	
	Yes	No
20. Do you feel that you have a lot of choice in deciding who your friends are?		
21. If you find a four leaf clover do you believe that it might bring you good luck?		
22. Do you often feel that whether you do your homework has much to do with what kind of grades you get?		
23. Do you feel that when a kid your age decides to hit you, there's little you can do to stop him or her?		
24. Have you ever had a good luck charm?		
25. Do you believe that whether or not people like you depends on how you act?		
26. Will your parents usually help you if you ask them to?		
27. Have you felt that when people were mean to you it was usually for no reason at all?		
28. Most of the time, do you feel that you can change what might happen tomorrow by what you do today?		
29. Do you believe that when bad things are going to happen they just are going to happen no matter what you try to do to stop them?		
30. Do you think that kids can get their own way if they just keep trying?		
31. Most of the time do you find it useless to try to get your own way at home?		
32. Do you feel that when good things happen they happen because of hard work?		
33. Do you feel that when somebody your age wants to be your enemy there's little you can do to change matters?		
34. Do you feel that it's easy to get friends to do what you want them to?		
35. Do you usually feel that you have little to say about what you get to eat at home?		
36. Do you feel that when someone doesn't like you there's little you can do about it?		
37. Do you usually feel that it's almost useless to try in school because most other children are just plain smarter than you?		

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Item	Response	
	Yes	No
38. Are you the kind of person who believes that planning ahead makes things turn out better?		
39. Most of the time, do you feel that you have little to say about what your family decides to do?		
40. Do you think it's better to be smart than to be lucky?		

NAME _____ DATE _____

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Appendix B. Summary of SPSS Paired T-Test Scores by Gender and by Age

		SELECT IF		(SEX=2) FEMALES		PAIRS = PRE WITH POST							
		T-TEST											
VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	(DIFFERENCE) MEAN	STANDARD DEVIATION	STANDARD ERROR	2-TAIL CORR. PROB.	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.		
PRE		27.3077	3.172	.880									
	13	28.4615	5.109	1.417	-1.1538	3.262	.905	.787 .001	-1.28	12	.226		
POST													
		SELECT IF		(SEX=1) MALES									
		T-TEST											
PRE		26.2424	4.294	.748									
	33	27.0000	5.280	.919	-.7576	3.123	.544	.806 .000	-1.39	32	.173		
POST													
		SELECT IF		(AGE=9)									
		T-TEST											
PRE		24.3000	4.473	1.415									
	10	26.2000	5.673	1.794	-1.9000	4.067	1.286	.702 .024	-1.48	9	.174		
POST													
		SELECT IF		(AGE=10)									
		T-TEST											
PRE		27.0000	3.464	1.000									
	12	27.8333	5.952	1.718	-.8333	3.070	.986	.922 .000	-.94	11	.367		
POST													
		SELECT IF		(AGE=11)									
		T-TEST											
PRE		24.8333	2.994	1.222									
	6	26.8333	4.916	2.007	-2.0000	3.578	1.461	.691 .129	-1.37	5	.229		
POST													
		SELECT IF		(AGE=12)									
		T-TEST											
PRE		27.2500	4.400	1.536									
	8				.2500	2.188	.773	.868 .005	.32	7			
POST		27.0000	3.964	1.402									

SELECT IF (AGE=13)												
PRE		27.5000	3.109	1.553								
4		27.2500	5.679	2.839		.2500	2.754	1.377		.972	.028	.18
POST												.367

SELECT IF (AGE=14)												
VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	(DIFFERENCE) MEAN	STANDARD DEVIATION	STANDARD ERROR	2-TAIL CORR. PROB.	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.	
PRE		31.0000	3.339	1.780								
4		31.7500	5.377	2.689		-.7500	2.500	1.250		.923	.077	-.60
POST												.391

SELECT IF (AGE=15)												
PRE		26.5000	2.121	1.500								
2		26.0000	5.637	4.000		.5000	3.536	2.500		1.000	0	.20
POST												.874

SELECT IF (AGE LE 12)												
PRE		25.9444	3.978	.663								
36		27.0278	5.141	.857		-1.0833	3.281	.547		.770	.000	-1.98
POST												.055

SELECT IF (AGE GT 12)												
PRE		28.7000	3.466	1.096								
10		28.8000	5.534	1.750		-.1000	2.514	.795		.947	.000	-.13
POST												.903

APPENDIX C. TOTAL GROUP PAIRED T-TEST

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UNIVERSITY COMPUTER CENTER
UNIVERSITY OF ARIZONA

S P S S - - STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES

VERSION 9.0 (MOS/BE) -- MARCH 06, 1984

130000 CM MAXIMUM FIELD LENGTH REQUEST

RUN NAME T-TEST BY ALL PARTICIPANTS IN STUDY
VARIABLE LIST ID,SEX,PRE,POST,AGE,DIFF
INPUT MEDIUM CARDS
INPUT FORMAT FIXED(F2.0,F1.0,3F2.0,F1.0)

ACCORDING TO YOUR INPUT FORMAT, VARIABLES ARE TO BE READ AS FOLLOWS

VARIABLE	FORMAT	RECORD	COLUMNS
ID	F 2. 0	1	1- 2
SEX	F 1. 0	1	3- 3
PRE	F 2. 0	1	4- 5
POST	F 2. 0	1	6- 7
AGE	F 2. 0	1	8- 9
DIFF	F 1. 0	1	10- 10

THE INPUT FORMAT PROVIDES FOR 6 VARIABLES. 6 WILL BE READ.
IT PROVIDES FOR 1 RECORDS ("CARDS") PER CASE.
A MAXIMUM OF 10 "COLUMNS" ARE USED ON A RECORD.

N OF CASES UNKNOWN
SELECT IF (AGE GT 0)

CPU TIME REQUIRED.. .033 SECONDS

T-TEST PAIRS = PRE WITH POST
READ INPUT DATA

00036400 CM NEEDED FOR T-TEST

OPTION - 1
IGNORE MISSING VALUE INDICATORS
(NO MISSING VALUES DEFINED...OPTION 1 MAY HAVE BEEN FORCED)

BEST COPY AVAILABLE

BEST COPY AVAILABLE

END OF FILE ON FILE INPUT
AFTER READING 46 CASES FROM SUBFILE NONAME

T-TEST BY ALL PARTICIPANTS IN STUDY

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FILE NONAME (CREATION DATE = 05/09/85)

T - T E S T

VARIABLE	NUMBER OF CASES	MEAN	STANDARD DEVIATION	STANDARD ERROR	(DIFFERENCE) MEAN	STANDARD DEVIATION	STANDARD ERROR	2-TAIL CORR. PROB.	T VALUE	DEGREES OF FREEDOM	2-TAIL PROB.
PRE		26.5435	4.004	.590							
	46				-0.8696	3.131	.462	.801 .000	-1.98	45	.066
POST		27.4130	5.218	.769							

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